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13. ABSTRACT (Maximum 200 words) In 1972 the U.S. and the Soviet Union agreed to leave their territories vulnerable to strategic missile attack. This agreement was manifest in the Antiballistic Missile (ABM) Treaty. This Treaty prohibits deployment of nation-wide defenses against strategic missiles. Since then a new threat has arisen, theater missiles (TBMs), which threaten U.S. deployed forces and may impede the freedom of movement of those forces. In response to this new threat the U.S. has proposed a formidable response - state of the art theater missile defense (TMD). In order to clarify the interplay between the ABM Treaty and TMD President Clinton has proposed a "demonstrated capability" standard to distinguish between prohibited strategic missile defense and permitted theater missile defense. Some in the Arms Control community condemn his initiative and U.S. TMD developed in accordance with the standard the President proposes. This paper addresses the ABM Treaty, U.S. TMD, and the Arms Control criticism and concludes that U.S. TMD does not violate the Treaty and furthermore, the President's initiative demonstrates his commitment to the ABM Treaty.					
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USAWC STRATEGY RESEARCH PROJECT

TWIXT SCYLLA AND CHARYBDIS:
THEATER MISSILE DEFENSE AND THE ABM TREATY

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ABSTRACT

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In 1972 the United States and the Soviet Union agreed to leave their territory vulnerable to strategic nuclear missile attack. This agreement was manifest in the Antiballistic Missile (ABM) Treaty. This Treaty prohibits deployment of effective strategic missile defenses. Since that time a new threat has arisen, theater ballistic missiles, which threaten to endanger U.S. deployed forces and impede the freedom of movement of those forces. In response to this new threat the United States has proposed a formidable response - state of the art theater missile defense (TMD). In order to clarify the interplay between the ABM Treaty and TMD President Clinton has proposed a "demonstrated capability" standard to distinguish between missile defenses for strategic purposes, which are prohibited and missile defenses for theater purposes which are not prohibited. Some in the Arms Control community condemn his initiative and U.S. TMD to be developed in accordance with the standard he proposes. This paper addresses the ABM Treaty, U.S. TMD, and the Arms Control criticism and concludes that U.S. TMD does not violate the Treaty and furthermore, the President's initiative demonstrates his commitment to the ABM Treaty.

Twixt Scylla and Charybdis: Theater Missile Defense and the ABM Treaty

"The Men and Women who serve under the American Flag will be the ...best equipped...so long as I am President."¹

"...President Clinton...reaffirmed...U.S. commitment to the ABM Treaty."²

During the Gulf War a militarily impotent Saddam Hussein reached into the rear area of his potent adversary with a crude Scud theater ballistic missile (TBM) and killed 28 and injured 98 service men and women.³ The in terrorem effect of this and other Scud attacks was incalculable.⁴ Because such vulnerability was unacceptable,⁵ President Clinton chose to emphasize⁶ theater missile defense (TMD) rather than strategic national missile defense (NMD),⁷ and proposed an Anti-Ballistic Missile Treaty⁸ clarification of the demarcation between strategic missile defenses, which are governed by the ABM Treaty and theater (tactical) systems, which are not. Then, he reaffirmed U.S. commitment to the Treaty by rejecting Reagan and Bush initiatives⁹ by repudiating the broad interpretation of the ABM Treaty¹⁰ and retracting proposals to increase ABM sites, decrease restrictions on ABM development and transfer prohibitions.

In criticizing the President's clarification initiative, several arms control specialists wrote, in "Highly Capable Theater Missile Defenses and the ABM Treaty,"¹¹ [hereafter Gronlund] that the

President's demarcation proposal, and U.S. TMD tested in accordance with that proposal will "undermine the core of what the ABM Treaty was designed to prohibit."¹² Some applaud the President,¹³ others say he is not going far enough,¹⁴ yet others are neutral.¹⁵ Congress has consistently supported TMD,¹⁶ yet most Democrats oppose the President's initiative as threatening the Treaty and Republicans oppose it because it limits U.S. capability.¹⁷ Who is right?

As the President navigates security straits must he veer toward Scylla¹⁸ to support the ABM Treaty or Charybdis¹⁹ to support TMD? Can he sustain the Treaty and provide robust TMD? This paper explains that the existing threat justifies the U.S. TMD program, and shows that the Treaty needs clarification in order to remain relevant, as it was never intended to foreclose TMD. It examines the conclusions reached by Gronlund et al and argues that the President's initiative, far from threatening the Treaty, will prolong its relevance rather than portending its demise.

Is the Theater Threat Real or Aggrandized? The world is brimming with weapons of mass destruction and TBMs to deliver them.²⁰ Outlaw states, against whom deterrence may not be effective, have missiles giving them power disproportionate to their stature.²¹ This presents a threat the U.S. cannot now defend against.²² This vulnerability has been scoffed at by some arms control advocates.²³ Yet, former Secretary of Defense Aspin said: "Saddam Hussein and the Scud missiles showed us that we need a ballistic missile defense for our forces in

the field. That threat is here and now..."²⁴ Former CIA Director Woolsey said that 25 countries are developing theater missiles.²⁵ The Czech Republic, Egypt, India, Iran, Iraq, Israel, Libya, North Korea, Pakistan, Saudi Arabia and Syria²⁶ are developing or possess TBMs with re-entry velocities exceeding 2.0 km/s, and ranges of 500 km.²⁷ The fact that Iran, Iraq, Libya, North Korea and China have TBMs should give pause, even to opponents of TMD.²⁸ There are between 1,400 and 2,000 TBMs extant, excluding NATO, Russia and Japan. Most are less than 900 kilometers in range,²⁹ though about 150 have ranges between 900 and 3,000 km.³⁰ Some say emphasis on TMD is misplaced, as friendly nations possess most TBMs.³¹ This ignores the possibility of TBM purchase, transfer of technology to incorrigible nations, or conversion of friends with missiles into enemies with missiles. Friendship in international relations is transitory, not immutable.

North Korea and Iran, not exactly paradigms of international civility, present real and growing TBM threats. Previously thought to have missiles only in the 300-600 km range, North Korea is in the process of developing No Dong and Taepo Dong 1 and 2, with ranges of 1,000, 2,000 and 3500 km respectively.³² This capability and willingness to sell it, should convince skeptics that prudence dictates robust U.S. TMD. Iran is assembling its own enhanced-performance Scud-B missiles, with help from China and North Korea,³³ and plans to acquire the No Dong 1.³⁴ This is of grave concern since Russia may sell nuclear reactors to Iran.³⁵ Since the U.S. can defend

against none of these, a defensive gap of strategic moment is evident. Failure to respond would be unforgivably naive.

The Response - The U.S. TMD Program Since 1991 the focus of U.S. missile defense has been TMD rather than "Star Wars."³⁶ The threat is well-defined: TBM ranges of 80-3,000 km; velocities between 1-5 km/s; proliferating, and improving technical capabilities including theater countermeasures.³⁷ Given these threat characteristics, the U.S. is developing a "core" program consisting of, Patriot Antitactical Missile Capability-3, (PAC 3), the Theater High Altitude Area Defense System (THAAD), and Sea Based Area Theater Ballistic Missile Defense (TBMD).³⁸ None of these is intended to have strategic capability.

PAC 3 is the Patriot upgrade. During the Gulf War, to counter previously unopposable Scud missiles, the U.S. improved the Patriot air-defense surface to air missile (SAM) system. While there is debate over its effectiveness,³⁹ its psychological value was spectacular. Yet, a gap in capability exists, since the Scuds used by Iraq represented only short range TBMs.⁴⁰ PAC-3 will partially fill the gap and provide lower-tier coverage against short range TBMs of a range up to about 1,000 km. It will employ a hit-to-kill interceptor, the Extended Range Interceptor (ERINT).

THAAD⁴¹ will counter numerous theater missiles in the interstice between threats PAC 3 is intended to counter and 3000 km. THAAD's purpose is not to defend the U.S., but to defend dispersed assets and

U.S. forces in a theater of operations. It is a single stage hit-to-kill interceptor with an infrared seeker. Its phased-array radar is transportable,⁴² more powerful than the PAC-3 radar, but within the Treaty limit for non-ABM radars.⁴³

The sea based TBMD effort leverages existing AEGIS air defense technology. The AEGIS ship radar, the AN/SPY -1B, fire control system and Standard Missile SM-2 Block IV will be upgraded to have capability against TBMs of the same lower apogee magnitude as PAC-3 targets, using a blast fragmentation warhead. The radar and weapon control system will perform surveillance and tracking functions, predict intercept points and engagement boundaries for TBM targets, conduct firings and provide uplink commands.

BMDO is also exploring several advanced concepts, including Navy Theater-Wide Defense to defend in the ascent and descent⁴⁴ phases of a TBM's trajectory; Airborne Boost Phase Intercept, which may provide a defense against early release of submunitions,⁴⁵ and Corps SAM, a mobile air-defense/TMD system.

Today, we are vulnerable to TBMs. The President has set a course to remedy this vulnerability. There are those who question the threat, and say in any case that the existence of a threat does not give the United States the right to violate the ABM Treaty.⁴⁶ While the purpose of our TMD program is to destroy short-range missiles, there is the potential that these TMD systems could also have some

marginal, technical, theoretical capability (dual-capability) against strategic missiles. Must we then spurn the Treaty to defend our forces? What does the Treaty forbid?

The ABM Treaty Before the ABM Treaty, the U.S. and Soviet Union thought that ABM systems with nuclear-tipped interceptors could sufficiently reduce strategic missile attack damage to merit deployment.⁴⁷ The Soviets went so far as to say "ABMs were good because they did not kill people."⁴⁸ While both sides researched and pursued ABM systems, the American program progressed only to skeletal Spartan and Sprint systems, as opposed to developed Soviet systems of Griffon missiles around Leningrad, and Galosh missiles around Moscow. The answer to this missile defense "race" was the disarmingly simple, deceptively circumspect, appallingly ambiguous ABM Treaty.⁴⁹

The Treaty was founded upon "...the premise that the limitation of anti-ballistic missile systems...would contribute to the creation of more favorable conditions for further negotiations on limiting strategic arms."⁵⁰ The parties could have guaranteed deterrence or stability through missile defense, but they did not.⁵¹ It was thought that missile defense would lead inexorably to an offensive/defensive race, which the offense can always win.⁵² Instead, they chose to leave their populations vulnerable to strategic ballistic missiles, undertaking "not to deploy ABM systems for defense of the territory...not to provide a base for such a defense, and not to deploy ABM systems...except as provided for in Article III...."⁵³ The

resultant vulnerability has been termed mutual assured destruction (MAD).⁵⁴ MAD is based upon the proposition that a nation impervious to missile attack might strike first, rendering nugatory a retaliatory, second strike. Conversely, if populations were clearly at risk, what nation would endanger them by launching a first strike? This theory triumphed in the ABM Treaty; a victory for arms control.

The Treaty is considered by some to be "...the...most important bilateral arms control achievement between the United States and the Soviet Union...It was...linked...to limitations on strategic offensive systems."⁵⁵ Yet, after the Treaty the Soviet Union greatly increased its offensive nuclear force while American strategic weapons rose slightly.⁵⁶ It can be argued, however, that the Treaty lead to a milieu in which offensive arms could be limited. In any case, strategic defenses were strictly limited.⁵⁷ "[The ABM Treaty] has effectively prevented the parties from expanding their strategic defensive arsenals...(and) permitted both governments to pursue...reductions of strategic missiles, submarines, and bombers."⁵⁸

ARTICLE I & II of the Treaty In Article I the parties agreed to limit ABM systems and not provide for a defense of the "territory" of the nation or provide a base for such a defense, except as specified article III.⁵⁹ "ABM system" is defined in article II as being a "system to counter strategic (emph. added) ballistic missiles," consisting of ABM interceptors, ABM launchers and ABM radars, "constructed and deployed for an ABM role," or for interceptors and

radars, "tested in an ABM mode." Thus, a system or components can become ABM if specifically constructed or deployed for an ABM purpose, capability being of no consequence, or if tested in an ABM mode. An ABM system may not be developed by giving non-ABM systems or components ABM capability as this would violate Article VI.

ARTICLE III Article III authorizes deployment of a limited ABM system. Originally, two sites each were allowed - one at the national capital region and one protecting ICBM silo launchers. This was later changed to authorize one site each.⁶⁰ The Soviet Union chose to defend its national capital region and the United States an ICBM field near Grand Forks, North Dakota.⁶¹ The parties may deploy, in that area, not greater than a radius of one hundred and fifty kilometers, no more than one hundred ABM launchers and ABM interceptor missiles and specifically defined phased-array radar complexes.⁶² Thus, ABM systems are legal, limited geographically and numerically, and not generally by capability. Compliance with the Treaty is assessed by national technical means⁶³ with no inspections prescribed.

ARTICLE IV The numerical and geographical method of circumscribing strategic capability is carried forward into Article IV of the Treaty which provides for ABM testing only at self-identified ranges. Each party is authorized fifteen (total) launchers at those ranges.⁶⁴

ARTICLE V ABM components must be fixed and land-based within the deployment area. Article V(1) prohibits development, testing or

deployment of ABM systems or components which are sea-based, air-based, space-based, or mobile land-based. If mobility is prohibited, why aren't THAAD, Navy TMD and PAC-3 illegal? Because they are not ABM systems; they are TMD, not "tested in an ABM mode."

Article VI - The epitome of ambiguity: Article VI is seized upon by opponents to condemn THAAD: "To enhance assurance of the limitations on ABM systems and their components provided by the Treaty, each Party undertakes: (a) not to give missiles, launchers or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles, or their elements in flight trajectory, and not to test them in an ABM mode..." While the Treaty was to limit strategic ABM systems, during ABM negotiations the U.S. sought to limit the capability of non-ABM Soviet surface to air (SAM) systems or components to preclude them from obtaining strategic capability.⁶⁵ Yet, "The Soviet(s)...lost no time in challenging our proposed ban on upgrading SAM anti-aircraft systems to give them an ABM capability. This was only a hypothetical possibility, they argued. If a side wanted ballistic missile defenses, it would have systems especially designed for that purpose and not use a redesigned anti-aircraft system. It was difficult enough to develop a genuine ABM system. One (Russian)...said even an automatic rifle could once in a very great while shoot down an airplane, but that did not make...small arms potential anti-aircraft defenses." (emph. added).⁶⁶ Yet, it was known that: "The Soviet SAM systems have an inherent dual nature, or residual ABM capability..."⁶⁷

This dual-capability has been much discussed: "Given some external means of cuing the radars..., the air defense system could offer some ABM defense capability if the interceptor guidance system were modified appropriately, if the interceptor speed were increased to 2 to 3 kilometers per second, and if the system had been tested in an ABM mode."⁶⁸

"The SA-12...probably does have some residual capabilities against older and slower types of SLBMs and ICBMs, by virtue of its high (for a SAM) burnout velocity, mobile phased-array radar, and relatively large payload (inferred). The U.S. counterpart, Patriot, probably has a similar overall residual capability, with a somewhat slower missile, but a somewhat more powerful radar."⁶⁹

"Systems with an ATBM capability might also be effective against SLBMs, which fly at a similar speed, flight trajectory, and reentry angle to MRBMs and IRBMs."⁷⁰

True enough, such air defense systems, given very favorable circumstances, could hit a single falling strategic warhead, or come close enough to destroy its accuracy. But, as a result of Soviet unwillingness to be bound, this theoretical, incidental, inherent, dual capability was not prohibited with sufficient particularity to be efficacious or understandable, or more importantly, enforced.⁷¹ To have absolutely prohibited any capability would have impinged directly on the Soviet SAM systems at myriad air defense sites. The ban on

"upgrading" these systems was agreed, but the price was ambiguity. The Soviets stoutly resisted particularity. As agreed, the Treaty precludes parties from giving non-ABM components (whatever these are), capabilities, (whatever these are), to counter (whatever that means) strategic ballistic missiles (whatever these are) or testing them in an ABM mode (whatever that means).⁷² It is inconceivable, given this interpretive miasmic bog, that anyone can say with certainty exactly what TMD capabilities can be said to be prohibited.

What "capabilities" are forbidden by Article VI? Does the Treaty forbid a non-ABM component or systems from having a demonstrated capability to "defend" a point, a region or the nation against a single SLBM or ICBM? Does "capability" mean the ability to fend off a nationwide "heavy" attack of "modern" strategic missiles? Can a system be "given" capability without being tested in an ABM mode, or is such a test the sine qua non of capability?⁷³ Does the Treaty forbid TMD which demonstrate a computer generated theoretical capability or must that capability be somehow demonstrated? Who knows? The absence of definition is the defining issue. The parties could have prescribed performance limitations on interceptors and/or radars, but they did not. If parties are prohibited from giving non-ABM systems even theoretical, de minimis capabilities to counter strategic ballistic missiles and "capabilities" are undefined, how can compliance be measured? Is compliance assessment wholly subjective, depending on the purity of the heart of the assessing nation? The lack of criteria leaves the parties without an objective basis upon which to judge

systems. This problem is intensified by the nature of the ABM Treaty as one verified only by NTM. How are the parties to know that the other side has not given forbidden capabilities to non-ABM systems?

The "capabilities" ambiguity is total: "Air defense systems, (and) ATBM systems..have some inherent capability to counter strategic ballistic missiles....Just how much ABM capability must a system or component primarily or ostensibly intended for one of these other missions have before it would be considered to violate the Treaty?...Should ABM capability be defined in terms of technical characteristics of devices that might be part of an ABM system? If so, by what process would these definitions be updated to keep abreast of technological change? How would compliance be verified?"⁷⁴

What is a Strategic Ballistic Missile? Article VI forbids giving non-ABM components capabilities to counter strategic missiles. Yet, the term is not defined; nor is there a common understanding. One way to define "strategic" may be range/velocity. The SALT Interim Agreement sheds light on what was meant by strategic for offensive arms control.⁷⁵ This agreement limited fixed, land-based ICBM launchers and modern submarine launched ballistic missile [SLBM] launchers.⁷⁶ Under its provisions, an ICBM launcher was strategic when it could launch ballistic missiles with ranges greater than the shortest distance between the North Eastern boundary of the United States and the North Western border of the Soviet Union, about 5500

kilometers.⁷⁷ Yet, limitations were not inextricably linked to range as SLBM launchers could launch at closer range than 5500 km.

The Agreement provided that the Parties would limit launchers of SLBMs and "modern" ballistic missile submarines to those operational and under construction as of the date of the Interim Agreement. To this baseline, launchers of older type SLBMs deployed prior to 1964 and launchers sited on older submarines were added. A Protocol was added which defined numbers of submarine launch platforms, and governed the replacement of older submarines.⁷⁸ Not surprisingly, the meaning of "strategic" was not clear. Because of the mix of old and new submarines carrying missiles capable of striking the United States, the Soviet SS-N-5 missile, with a range of about 1,400 kilometers, was "strategic" if carried on a nuclear-powered submarine, but not strategic if carried on a diesel-electric submarine."⁷⁹ Additionally, the 2,000 km range SS-4 was not "strategic" under the Interim agreement. Range criteria are indeed hard to isolate. So, our TMD could legally have capability against an SS-N 5, if it was on a diesel sub, but not if it was on a nuclear sub!

What is a strategic ballistic missile for purposes of assessing the forbidden capability? Are SS-N-5s forever the standard to assess TMD capability? Are modern SS-25s the standard? What about SLBMs which can have extremely short ranges, i.e., 500 kilometers when adjusted by "lofting" the trajectory and if the submarine carrying the missile is parked off the Florida coast?⁸⁰ It is hard to know if

capability is given, if we don't know what to assess capability against, what method of assessment to use or what capability is.

Testing in an ABM Mode Article VI forbids testing of non-ABM components "intended" for ABM purposes, thus introducing an element of subjectivity.⁸¹ This standard recognizes that before a system not designed for ABM purposes could have ABM "capabilities," testing in an ABM mode is a critical step.⁸² But, what does it mean to "test in an ABM mode?" To run a computer simulation? To actually test against strategic targets?

In 1972 the U.S. unilaterally described "tested in an ABM mode,"⁸³ to occur when, for example, a launcher is used to launch an ABM interceptor missile, an interceptor missile is flight tested against a target with characteristics of a strategic ballistic missile flight trajectory, (undefined) or a non-ABM component is tested in conjunction with an ABM interceptor or an ABM radar at the same test range, or is tested to an altitude inconsistent with interception of targets against which air defenses are deployed. In 1978 the Parties agreed to a further description of "testing in an ABM mode," which similarly provided few specifics,⁸⁴ and avoids target altitude or performance characteristics. That purported to be defined is not.

To fill this definitional gap, some, including Gronlund et al, in their harsh attack on recent U.S. clarification initiatives and THAAD, describe the "Foster Box" (a velocity and altitude "box" or limit) as

the criteria to distinguish between strategic and theater test targets.⁸⁵ Yet, the Foster Box was merely a 1972 threshold to screen tests when target velocity was 2 km/s or of an altitude of 40 km⁸⁶ to determine if compliance review was needed to avoid "testing in an ABM mode."⁸⁷ This was Dr. John Foster's opinion,⁸⁸ never agreed or adhered to by the Soviet Union, or used as a basis to charge Soviet violations.⁸⁹ Those who invoke it unnecessarily limit U.S. testing.⁹⁰

Assuming arguendo that the Foster Box has some purpose, what is it? If Dr. Foster was saying 2 kilometers per second is the fastest theater target a non-strategic system should test against, for to exceed it would give strategic capability, in 1972 the slowest SLBM was SS-N-5 with a range of 1,400 kilometers and a velocity of 3.5 kilometers per second. The "buffer" or difference in velocities between the "Foster" 2 km/s and the SS-N-5 was 1.5 km/s. Today, if we assume a 5 km/s target limitation for non-ABM testing, the buffer is 2 kilometers per second, since modern ICBMs and SLBMs approach or exceed 7 km/s.⁹¹ Even though the Foster Box is not the law of the Treaty, any buffer suggested by it is easily preserved.

Given the foregoing, in the absence of any objective standard, subjective capability and testing judgments must be made, based on assumptions about ambiguities. This inevitably leads to asymmetric capability analysis. If the parties are not equally bound, the Treaty cannot stand. This is hardly the way to preserve a Treaty. As was observed relative to another Treaty ambiguity: "In the absence of

agreement, U.S. and Soviet officials must...make independent judgments about the... dividing line between an adjunct and a component in particular cases. Each side has the opportunity, and incentives, to press against the Treaty's limits in its program and to challenge the compliance of the other side."⁹²

For the present, parties must use good faith in interpreting the words of the Treaty. But, good faith need not mean a party has to use extreme interpretation which militates against its national interest, pretending a fixed, clear definition is discernable when none exists. Thus, ambiguity dictates confusion as we seek to uphold our obligations under the Treaty and not unnecessarily limit capabilities against "rest of world" TBMs. The parties never agreed to remain vulnerable to the rest of the world. While the U.S. should keep its obligations with exactness, it should not unilaterally assume a standard not mutually observed, nor unilaterally assume obligations not undertaken. To clarify the confusion and provide an objective standard for assessment, President Clinton has proposed a solution.

The President's Proposal to Clarify In 1993 President Clinton proposed a standard which would clarify the demarcation between theater and strategic defense capabilities: If a TMD system does not demonstrate a capability, i.e., test against targets which exceed a velocity of 5 km/s and concomitant range of 3,000 km, the system is not an ABM system nor tested in an ABM mode.⁹³ The essence of this approach is that since technical characteristics are not specified in

the Treaty, if the parties only test against extant theater missile targets, a buffer will be preserved between capability to counter such targets and much faster and more capable strategic ballistic missiles.

This approach was blessed by Congress: "Congress urges the President to pursue immediate discussions...to permit ... clarification...between theater missile defenses and anti-ballistic missile defenses...."⁹⁴ The specifics were blessed by Congress: "The ABM Treaty...does [not] ... limit... missile defense systems.... designed to counter modern theater ballistic missiles, regardless of the capabilities of such missiles, unless...[they are] tested against or have demonstrated capabilities (emph. added) to counter modern strategic ballistic missiles."⁹⁵

The President's proposal has several advantages. It is readily discernable by NTM. It reflects the threat in the world today. It allows flexibility for future technological development, limiting testing in a strategic range, but does not burden development of TMD technology not tested for ABM capability. It preserves the buffer between strategic and theater capability and shows U.S. willingness to negotiate in order to preserve the Treaty. The administration could have, in light of overwhelming ambiguity, unilaterally declared the President's proposed demonstrated capability standard. After all, the Soviets demanded ambiguity. Instead, the President proposed a clear, verifiable, reasonable, demarcation. The demarcation is needed. The Treaty started out ambiguous and time, technology and geopolitical

shift have exacerbated that ambiguity. Today a pressing need exists for clarification.⁹⁶

Many have noted this problem: "The ABM Treaty is written in terms of early 1970s technology and will require clarifications and amendments...The lack of specific detail reflects the pervasive concern of the Soviets for security matters and their determination to divulge or confirm as little...as possible."⁹⁷

"The fact that the United States and the Soviet Union have not agreed upon performance criteria to distinguish between strategic and nonstrategic ballistic missiles for purposes of the ABM Treaty has led to confusion between the ATBM capability and ABM capability...."⁹⁸

"(I)n addition to the SDI the most important issue that should be addressed in the near future is the problem of "gray-area" weapon systems and technologies, such as LPARs, ASATS, and ATBMs."⁹⁹

"The United States should not abandon the ABM Treaty, but should begin discussions ...to clarify its terms...to distinguish theater missile defenses from strategic missile defenses..."¹⁰⁰

"We will need to clarify...what constitutes ABM capability...to distinguish between that capability and TMD capability."¹⁰¹

One fact is not ambiguous, the Treaty is. Another non-ambiguity is that the Parties never contemplated remaining vulnerable to anything but strategic ballistic missiles and never agreed vulnerability against third world TBMs. President Clinton seeks to preserve the Treaty and pursue U.S. TMD. He has proposed a reasonable standard for doing both. Some disagree.

The Gronlund et al Article In "Highly Capable Theater Missile Defenses and the ABM Treaty"¹⁰², several prominent arms control experts purport to show that THAAD will endanger the ABM Treaty because of its supposed capability against Russian strategic ballistic missiles. Though the authors agree the Treaty is ambiguous,¹⁰³ they unambiguously claim that "the administration's proposals could well have the effect of eliminating the ABM Treaty as a practical mechanism for preventing the deployment of significant defenses against strategic missiles."¹⁰⁴ The authors interpret ambiguity against U.S. TMD, presuming that the Treaty prescribes obligations with precision, implying that somehow U.S. THAAD departs from past Treaty practice. The article claims that THAAD (not designed, tested or deployed as an ABM system) will be so effective against strategic missiles so as to doom the Treaty. If adopted as policy this view would force an unnecessary choice between the Treaty and TMD.

Primary Conclusions Gronlund et al claim that THAAD-like systems, if able to intercept modern theater missiles, would almost certainly have significant capabilities against strategic missiles and hence, the

President's proposed clarification could undermine the core of what the ABM Treaty was designed to prohibit.¹⁰⁵ These conclusions are arrived at by creation of kinematic footprints which show large THAAD "defended areas" against ICBMs and TBMs. Adjectival caveat and disclaimer notwithstanding, these footprints have been widely used by Russian and U.S. critics to oppose U.S. TMD.¹⁰⁶ The inescapable conclusion of the paper is, since the ABM Treaty prohibits any capabilities against strategic ballistic missiles there can be no defense against TBMs-the only legal TMD being no TMD.¹⁰⁷ As will be shown, the authors assumptions undermine their conclusions.

Method and Assumptions The article equates THAAD's theoretical kinematic ability, and acquisition radar range assumptions, with "defended area," i.e., the area on the ground it can "protect."¹⁰⁸ A footprint supposedly demonstrates what capability a defensive system should have given certain assumptions. Depending on the fidelity of the footprint desired, certain parameters may be used such as radar cross section (RCS), radar range for acquisition (a radar will detect a larger cross section at greater distances than a smaller cross section target),¹⁰⁹ interceptor characteristics and target characteristics. But, as the Congressional Budget Office has said: "...(F)ootprint calculations....represent the so-called kinematic-or theoretical-capabilities...and do not reflect the probability that an incoming warhead will be destroyed...."¹¹⁰ (Emph. added.) The reason for such caution is that a footprint will reflect the assumptions used to construct it. If assumptions are incomplete, omitting critical,

realistic factors, the footprint will be misleading, by implying that the defensive systems can "keep out" all incoming targets.

Footprint Analysis is Less Than It Appears to Be. Though footprint analysis can be useful in determining whether a system has sufficient range to be capable against certain targets, "(F)ootprint analysis, as used by critics, provides a misleading assessment of...capability."¹¹ It is misleading as used because it shows range capabilities not defensive capabilities.

Consider a baseball analogy. The strike zone is between my knees and letters. I have a bat in hand and can reach across home plate; I have theoretical "capability" (reach) and sufficient vision to cover the strike zone. Having said that, we know nothing of my actual ability to "defend" it. If my 13 year old throws the ball across the plate I could hit it, though probably not very far. If a minor league pitcher threw the ball I could not get wood on the ball. If Nolan Ryan was standing on the mound I wouldn't step up to the plate. If 10 Nolan Ryan's were prepared to pitch at once I wouldn't even come to the ball park. Do I have real capability? This imperfect analogy shows the potential weakness of kinematic footprint analysis.

Analysis which does not take into account myriad "real world" characteristics of target missiles may leave the unfortunate impression that footprints equal an area which can be defended. This is not the case. Footprint analysis, as employed by the authors, did

not include many complicating assumptions pertaining to strategic Rvs¹¹² such as electronic counter measures, penetration aids and decoys, varied launchpoints, contact fuzing, post-boost vehicles,¹¹³ depressed trajectories, environmental effects on the radar such as electro-magnetic pulse or nuclear blast effects, multiple Rvs, off-boresight engagements, or multiple azimuth targets. Essentially, the means a strategic attacker has to confound the defense were ignored. The authors took a computer simulation, devoid of most realistic engagement factors, made unrealistic assumptions and discovered a capability so robust as to threaten the Treaty. The authors recognize this defect, but dismiss it, assuming "relative"¹¹⁴ performance of the THAAD-like system against strategic and theater missiles, so that the "conclusions should be relatively insensitive to the details of the models."¹¹⁵ This ignores reality. We are obligated under the Treaty to deal with reality. A realistic capability assessment is very sensitive to "details."

An examination of comments by members of the Gronlund team in different contexts demonstrates how important realistic details can be. For example in April 1991, Dr. Theodore A. Postol testified concerning Patriot's lack of capability against short-range Scud targets:¹¹⁶ "The problems that the Patriot had intercepting Scuds underscores how difficult it is to stop a falling missile from hitting the ground with a non-nuclear intercept."¹¹⁷ And, "Since SDI interceptors are hit-to-kill vehicles, or have non-nuclear explosive warheads, they would be especially easy to defeat with counter-

measures. This could simply be accomplished by surrounding target missiles or warheads with clouds of nearby decoys. Homing SDI interceptors would then be unlikely to choose the right target."¹¹⁸ Finally, he said, "...even modest countermeasures combined with surprise will seriously degrade quite capable defenses. Almost all SDI scenarios unrealistically require that the defense perform the first time with near perfection and under all imagined and unimagined conditions."¹¹⁹ Yet, Gronlund et al in their article assumed perfection of theater defenses against sophisticated strategic targets. If it is hard to hit a slow TBM (1-5 km/s) how much more difficult it is to hit a strategic target (7 km/s more) supported by sophisticated countermeasures¹²⁰

The difficulty in overcoming countermeasures was discussed in a criticism of "Star Wars" by another of the authors:¹²¹ "If an adversary chose to attack with missiles, it could employ countermeasures to foil the SDI defense....(E)ven in the absence of countermeasures, a defense system could be vulnerable to hidden errors or limitations in its own computer software. In either case, the defense could be rendered partially or wholly ineffective."¹²² Those limitations were eschewed in the THAAD analysis.

In a paper written at Stanford in the 1980s,¹²³ Dr. Postol joined with several others in dismissing U.S. concerns about ABM capabilities of Soviet air defense dual-capable systems: "An attack can be optimized in the presence of defenses if it employs defense

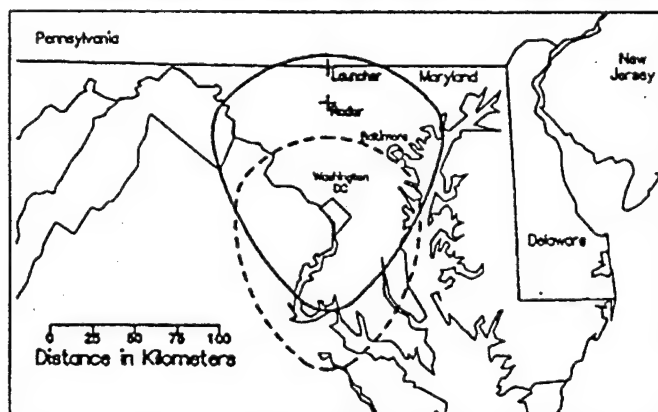
suppression tactics."¹²⁴ And: "Although interceptors designed for a SAM or ATBM mission could intercept strategic ballistic trajectories under certain conditions and geometries, one must recognize that the offense has a fair amount of control about the attack signature and geometry. Therefore, in evaluating whether a territorial defense is evolving which uses multiple-purpose interceptors in an ABM role, the limited effectiveness (emph. added)...against certain types of strategic ballistic missile attack should be clearly recognized."¹²⁵ "... (A) system whose successful operation is contingent on so many conditionals could hardly represent a reliable enough defense against nuclear attack to threaten the US deterrent."¹²⁶

The paper rationalized Soviet non-ABM dual capability: "....The US concern is that the mobile SA-X-12, a SAM now being tested for the upgrade of the permitted Soviet ABM defense of Moscow, has an anti-tactical ballistic missile intercept capability which could equip the system to attack some SLBMs, if deployed with a nuclear warhead. The SA-X-12 was observed in 1983 and 1984 in tests against a missile similar to the SS-12¹²⁷ tactical ballistic missile, which raises the question of whether the Soviets are testing the SA-X-12 in an ABM mode...However, both sides are permitted to develop, test and deploy interceptors to attack incoming tactical ballistic missiles." (emph. added)¹²⁸ Gronlund et al could have similarly warned: "It makes little sense...to take one or several activities which could have ABM potential and make a determination...that a country may be preparing

an ABM defense of its territory."¹²⁹ Instead, Gronlund et al left the contrary implication.

Gronlund Figure 1.¹³⁰ The authors created a 10,000 square km footprint for THAAD-like ATBM centered over Washington D.C. against a 3,000 km (5 km/s) TBM and a smaller footprint against an ICBM with a range of 10,000 km (7 km/s).

Figure 1. Ballistic Missile Defense 'Footprints' Against Theater and Strategic Targets.



The above figure shows the defended footprints calculated for a THAAD-like anti-tactical ballistic missile (ATBM) against a 3,000-kilometer range theater missile (solid line) and a 10,000-kilometer range strategic missile (dashed line). The footprints in this model assume the ATBM radar has a power-aperture product of 500,000 watts-meter squared and that the attacking reentry vehicles (coming from the top of the figure) have a radar cross section of 0.05 square meters.

Figure 1

To obtain the strategic footprint, the authors assumed that theater and strategic Rvs possess the same radar cross section, i.e., .05 m² or -13 DBSM.¹³¹ Yet, strategic targets generally present a smaller RCS than theater targets.¹³² This levelling assumption

shrinks the "relative" distinction. Next, the footprint assumes only one attacking warhead. The authors recognize this weakness, but dismiss it by saying "If more than one target is approaching...the defended footprints will generally shrink...because the radar must divide its search capability...decreasing its detection range."¹³³ Unfortunately the conclusions the words evoke were omitted.

For a host of reasons, an attempt to counter a strategic attack using TMD systems will be ineffective. Because of the extreme velocity of ICBMs and SLBMs, and sophisticated countermeasures, any capability would be incidental, on a razor's edge. Dividing the radar's power would have a profound effect, dramatically decreasing its range. It is much easier to track larger, slower TBMs. Yet, the authors simply dismiss this problem with hypothetical verbal prestidigitation: "... (I)f more advanced early warning satellites are deployed that are able to provide more accurate missile trajectory data, the defended footprints will be larger than those shown in Figure 1."

Most importantly, in the fine-print, as opposed to the prominent footprints, the authors explain that the ATBM radar and launcher are not within the defended footprint against the strategic target, but are in the defended footprint against the theater target. Assuming that footprint equals defended area, this admission completely undermines the case the authors attempt to make against U.S. TMD. If a system cannot defend itself, it cannot defend ANY footprint. The

first incoming strategic ballistic missile obliterates the radar and launcher. How then can any footprint be defended?¹³⁴ On the other hand, against a TBM, the radar and launcher are within the "defended area." This is a clear "demarcation" rather than a satisfying condemnation of THAAD.¹³⁵ Undeterred, the authors postulate the problem away by saying, "The lack of self-defense capability is not necessarily as serious a problem as it might seem, since the high mobility of...U.S. ATBM systems would make them difficult to attack." Why are these radars "highly mobile?" They are transportable, but not mobile in the sense of hitching them to a transporter and rapidly moving them between the time an ICBM or SLBM is launched at them and when they are vaporized. While the United States is moving this "highly mobile" single radar, what sensor is tracking the strategic RV? Large phased-array radars cannot take measurements on the fly like some sort of police radar gun.

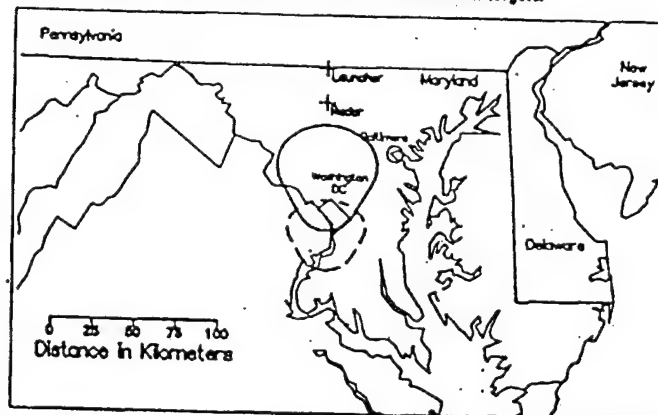
Sensing the weakness of their assertion, the authors again seek refuge in hypothetical: "The footprint of the ATBM system could be extended forward by increasing the power-aperture product of its radar, increasing the speed of its interceptors, or lowering their minimum intercept altitude. The launcher and radar might even be protected by a shorter-range ATBM system."¹³⁶ How do we metaphysically increase power aperture product? Do we turn up the rheostat on the radar? Are the authors hypothecating or analyzing? If are to presume circumvention, we can surely hypothecate easier scenarios, such as coupling the TMD system to early warning radars or

building 8 km/s TMD interceptors. Or, the Russians can deploy thousands of their already tested true ABM interceptors or add nuclear tips to their robust SA-12, if hypothesis supplants analysis.

Gronlund Figure 2 ¹³⁷

Here the footprints are dramatically shrunk because of a reasonable assumption about a strategic RV's RCS $-.005\text{m}^2$. The problem is that this is also assumed for the theater target. This is smaller than most theater targets, so the result is again a closer relative correlation than ought to exist. Yet, here neither launcher or radar are defended against either threat. The footprint is about 1/10th the size of Figure 1. This alarming (to the authors) shrinkage is offset in Figure 3 (below) by increasing radar power aperture product by a factor of 4.

Figure 2. Defended 'Footprints' Against Low Radar Cross Section Targets.



The above figure shows the defended footprints calculated for a THAAD-like ABM system against a 3,000-kilometer range theater missile (solid line) and a 10,000-kilometer range strategic missile (dashed line). The attacking reentry vehicles (coming from the top of the figure) have a radar cross section of 0.005 square meters, a reduction by a factor of 10 from those used in Figure 1.

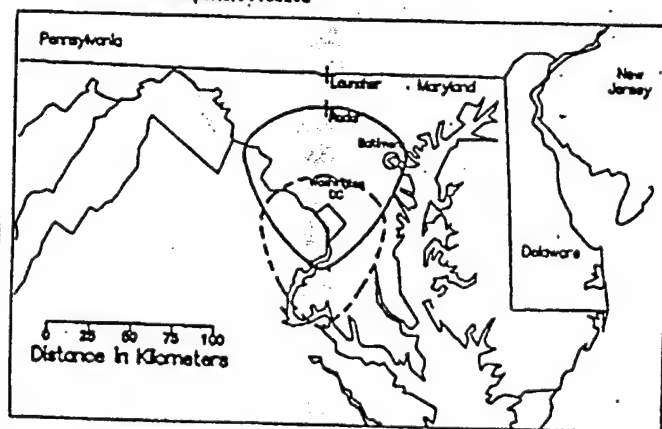
Figure 2

Gronlund Figure 3¹³⁸

Here the computer has created immense footprints covering all of Washington D.C. and environs. The problem is that this was accomplished by increasing the radar power-aperture to 2 million watt-m². How is this done, given the required transportability of a theater radar which was previously assumed to be 500,000 watt-m²? Do we just string together radars like strings of christmas tree lights? Even brooking a presumption of a transportable 2 million w-m² radar, as opposed to the postulated 500,000 w-m² version, there is no self-defense against any strategic threat.¹³⁹

In fact, the radar and launcher appear to be about 50 and 75 kilometers outside of the footprint respectively. This is no defense at all, as a laddered attack of ICBMs and SLBMs could easily negate any capability.¹⁴⁰ The authors' analysis proves that a THAAD-like system is not a threat to the Treaty.

Figure 3. Defended 'Footprints' Against Low Radar Cross Section Targets With Enhanced Radar Power-Aperture Product.



The above figure shows the footprints for a THAAD-like ATBM system against a 3,000-kilometer range theater missile (solid line) and a 10,000-kilometer range strategic missile (dashed line) whose reentry vehicles (coming from the top of the figure) have a low radar cross section (0.005 square meters). In this case the ATBM radar's power-aperture product has been increased by a factor of four.

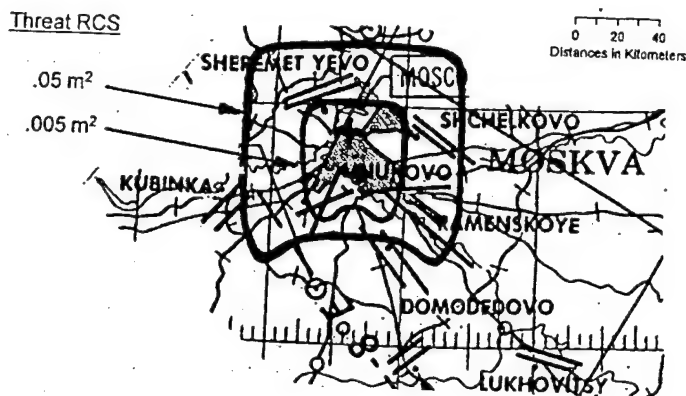
Figure 3

Let us add context to the Gronlund analysis. The authors did not analyze existing Russian air defense/TMD systems, like SA-12, to discern whether these systems would have precedential, comparable, theoretical, computer generated, strategic capability. Since these systems are numerous, and truly mobile, if capability exists which could be improved by implying use of existing radars or presuming improved sensors, or obtaining cues from very large extant radars on Russian soil, fairness should dictate that the authors would *pari pasu* express concerns about these systems. If SAMs had dual-capability in the 70s and 80s, today's versions have it now in spades.

Below, in Figure A, we use the Gronlund target assumptions and show theoretical SA-12 ABM "capability:" Target velocity 7 km/s; RCS of the target for the larger defended area over Moscow, .05 square meters and .005 for the smaller; Radar is 500,000 watt-m²; interceptor burn time is 17 seconds; blast fragmentation warhead; velocity, 2.4 km/s. SA-12 has strong endoatmospheric capability so it will operate very low in the atmosphere. Given those assumptions, the SA-12 has a large footprint against "strategic" ballistic missiles. Launcher and radar are in the defended area.¹⁴¹ Nuclear tip is not assumed.

FIGURE A. The "capability" should not be confused with defended area. This kinematic capability is based on unrealistic assumptions. These footprints are shown to demonstrate the potentially misleading use of footprint analysis. It is roughly the same size as postulated by Gronlund for THAAD-like systems.

SA-12's characteristics are taken from a Russian advertising brochure, Concern Antoy, S-300V, (1992) and Lennox, Ed., Jane's Strategic Weapons Systems, Issue 14, 1994.



- Co-located radar and interceptor
- Radar power-aperture product: 0.5×10^9 W-m²
- Search volume optimized for 7.0 km/sec threat

Figure A

Patriot had limited success against Scuds in the Gulf War. Does footprint analysis mislead us regarding its "capability" against a 600 km Scud-like threat? According to footprint analysis, Patriot had "capability" including self defense, to defend Tel Aviv and environs against Scud. Does the footprint reflect reality? Patriot's characteristics, 70 km range, and 100 km detection range, are from Lennox, Ed., Jane's Weapon Lennox, Ed., Jane's Weapon Systems, Issue 12, 1992.¹⁴²

Theoretical PAC-2 Footprint About Tel-Aviv



Figure B

Conclusion. There is a TBM threat. The U.S. response to that threat is justified legally and technically. The technical problems which confront TMD are difficult, but not as daunting as strategic missile defense. They are difficult enough without the creation of exaggerated, hypothetical, legal and policy impediments.¹⁴³ Penurious interpretations of the Treaty, coupled with analysis adopting unrealistic assumptions, are hazardous both to the Treaty and U.S. defensive measures against TBMs. If the Treaty is too rigid to adapt to changing technology, threats and political reality, then it may be doomed. What is needed is not post hoc treaty interpretation alchemy, changing the original meaning and intent of the Treaty to meet arms control objectives, but agreement on what the Parties deem to be in their interest today. President Clinton's commitment to the Treaty needs no clarification. He seeks to strengthen it. He has not, to the chagrin of U.S. theater missile defense opponents, left U.S. forces vulnerable to terrorist states. Nor has he decided, to the disappointment of opponents, to jettison the Treaty.¹⁴⁴ He is pursuing an approach which will protect our forces from the New World Disorder, while leaving the ABM Treaty in place.

The Treaty is what the Parties say it is. It is not received guidance. When agreement is reached on demarcation, it will be because the Parties agree it is in their best interest. When the United States deploys TMD it will be done in strict compliance with obligations under the ABM Treaty. To accuse the United States, during Treaty discussions, of undercutting the Treaty, undermines the U.S. negotiating position. The U.S. only seeks a clarification which will allow both sides to counter today's theater threat. In light of

almost overwhelming ambiguity, the ABM Treaty need not be interpreted to forbid countering that threat. Arms Control should not be used as a pretext to unnecessarily block U.S. technology. The President is staying the course twixt Scylla and Charybdis. Hopefully he will not be deterred by those who beguile him from either extreme.

END NOTES

1. President Clinton, quoted at L. Aspin, DoD Publication, Report on the Bottom Up Review, October 1993, p. iii.
2. Fact Sheet: The ABM Treaty and Current U.S. Ballistic Missile Defense Policy, Office of Public Information, United States Arms Control and Disarmament Agency, April, 1994, p. 3.
3. William Claiborne, Scud Kills 27 GIs at Dhahran Billet; 98 Are Wounded in Most Devastating Iraqi Missile Strike of War, Washington Post, Feb. 26, 1991 p. A1.
4. John Balzar, For Scud's Victims, No Safe Rear Area, L.A. Times, Mar. 3, 1991 p. A1.
5. But cf. "...During the Gulf War these missiles proved to be a major annoyance... but had no significant impact on the outcome of operations." J. Pike, A New Threat to the ABM Treaty: The Administration's TMD Proposal, Arms Control Today, Jan/Feb 1994, p. 13.
6. Aspin, note 1 p. 43; See, W. Perry, Design, not deployment key to missile defenses now, Wash. Times, Aug. 15, 1995, p. A8.
7. TMD (or ATBM-anti-tactical ballistic missiles) defends against short-range theater ballistic missiles (TBMs); NMD defends against long-range strategic missiles.
8. Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems, May 26, 1972, 23 UST 3435, TIAS No. 7503 [hereinafter ABMT or "the Treaty"].
9. S. Hildreth, The ABM Treaty and Theater Missile Defense: Proposed Changes and Potential Implications, (Congressional Research Service Report for Congress, May 2, 1994) p. 7.
10. Congressional Quarterly Weekly Report, STRATEGIC ARMS: Clinton Hews to Narrow View on ABM Treaty, Congressional Quarterly Weekly Report, Vol. 51, no. 29, (July 17, 1993) p. 1894. In 1985 the Reagan Administration announced that under a broad interpretation of the ABMT the U.S. could research, test and develop, but not deploy, space-based ABM systems based on "other physical principles." The narrow interpretation holds that research on such systems is legal, but development, testing and deployment are prohibited. See, A. Chayes and A.H. Chayes, Testing and Development of 'Exotic' ABM Systems Under the ABM Treaty: The Great Reinterpretation Caper, 99 Harv. L. Rev. 1956, (1986); K. Kennedy, Treaty Interpretation By the Executive

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11. L. Gronlund, G. Lewis, T. Postol and D. Wright, Highly Capable Theater Missile Defenses And the ABM Treaty, Arms Control Today, Apr. 1994, p. 3. [Hereafter, Gronlund]; J. Mendelsohn, Star Wars Redux, Issues in Science and Technology, Wint. 1994/1995, p. 65; J. Pike, Don't Imperil The Treaty, N. Y. Times, Oct. 25, 1994, p. 21; Ed., Why Weaken the ABM Treaty? N. Y. Times, Dec. 13, 1993, p. 16; Ed., A Dangerous Opening on ABM's, N.Y. Times, Apr. 11, 1994 p. 18, col. 1; Ed., Don't Gut the ABM Treaty, Christian Science Mon. Sept. 27, 1994, p. 27; Ed., Wrong Defense, Wrong Enemy, N.Y. Times, Nov. 16, 1994, p. 18.

12. Gronlund, ibid. p. 3. Some who claimed NMD is impossible, now claim that less capable TMD systems have too much capability. "Insurmountable technological and political obstacles will prevent us from developing an effective "shield" against nuclear weapons..." D. Wright & G. Lewis, The New Arms race: Star Wars Weapons, Briefing Paper 5, Union of Concerned Scientists, Oct. 1983; See also, Space-Based Missile Defense, A Report, Union of Concerned Scientists, Mar. 1984, p. 69.

13. S. Graybeal and P. McFate, The ABM Treaty and Ballistic Missile Defense: Can the Circle Be Squared?, Pamphlet, American Association for the Advancement of Science Publication 93-26S, 1993; S. Graybeal and P. McFate, Clinton Puts ABM on Target, Defense News, Jan. 31, 1994, p. 15; S. Graybeal and M. Krepon, It's Not Son of Star Wars, Bul. Atom. Scien., Mar/Apr 1994, p. 16; J. Holum, Don't Put Allies at Risk, N. Y. Times, Oct. 25, 1994 p. 21; M. Krepon, Security Still Means Fewer Nuclear Arms, The Commercial Appeal, Memphis, Aug. 27, 1995, p. 12; M. Krepon, Are Missile Defenses MAD? Combining Defenses with Arms Control, Foreign Affairs, Jan/Feb 1995, p. 19; Ed., Updating Missile Defense, Wash. Post, Oct. 30, 1994, p. C6; Ed., Wash. Post, To Counter Rogue Missiles, Feb. 5, 1995, p. C6.

14. K. Adelman, Let Missile Defenses Flow From the Deal, Wash. Times, Oct. 26, 1994, p. 15: "Some opinions are so stupid that only an intellectual could hold them," wrote George Orwell.... Imagine what Orwell would say...Russia now sees the value of ballistic missile defense, making the U.S. lawyers and traditional arms controllers the remaining holdouts. They wish to prevent us from taking reasonable precaution against a world chuckfull of ballistic missiles and more nuclear weapons." (Emph. added). See, W. Buckley, Hyde's Strategy to Defend America, Wash. Times, Sept. 22, 1995, p. A18; F. Gaffney, The Clinton Missile Gaffe, Wall St. J., May 19, 1995, p. 14; J. Hackett, Missile Defense Fate in New Hands, Wash. Times, Jan. 13, 1995, p. A17; J. Kirkpatrick, Hostage to the Missiles of the World's Outlaw States, Balt. Sun, Feb. 28, 1995, p. 11; C. Krauthammer, Time For

a Little Panic, Time, July 25, 1994 p. 74; G. Will, Outdated ABM Treaty Holds U.S. Hostage, Chi. Sun Times, Sept. 21, 1995, p. 37.

15. Hildreth, note 9, p. 23. "Many ...believe... that Treaty changes must be made to counter...threats from ballistic missiles to U.S. national security interests. Others believe the proposed changes could put the central purpose of the ABM Treaty and perhaps other U.S. arms control objectives at risk." See Also, Congressional Budget Office Papers, The Future of Theater Missile Defense, June 1994 [CBO]; General Accounting Office, Ballistic Missile Defense: Information on Theater High Altitude Area Defense (THAAD) System, GAO/NSIAD-94-107BR, January 1994.

16. Section 233(b) of the Missile Defense Act of 1991, P.L. 102-190 directed pursuit of advanced TMD. The 1994 DOD Authorization, §234(a), S. 1298; S. Rept. 103-112, p. 59 supported TMD: "(7)...The ABM Treaty was not intended to, and does not, apply to...missile defense systems...designed to counter modern theater ballistic missiles... regardless of their capabilities, unless [they] are tested against or have demonstrated capabilities to counter modern strategic ballistic missiles. (8)...[I]t is a national security priority of the United States to develop and deploy highly effective theater missile defense systems capable of countering...threats posed by modern theater ballistic missiles..." See, FY 94 DOD Auth. Conf. Rep., H.R. 2401; H. Rept. 103-357 p. 51-56. The Senate Report for FY 95 DOD Authorizations, S. 2182, S. Rept. 103-282 p. 135: "The committee applauds the Administration's efforts to seek...an agreed clarification of permissible limits to the capabilities of... (TMD) systems." Adopted at FY 95 DOD Auth. Conf. Rep., S. 2182; H. Rept. 103-701 p. 638.

17. W. Lippman, Missile Treaty Changes Opposed, Wash. Post, Mar. 11, 1994, p. 8; W. Gertz, Hill GOP Leadership opposes Clinton missile-defense limits, Wash. Times, Feb. 20, 1996, p. A4. W. Gertz, Trouble brews for U.S.-Russia missile talks, Wash. Times, Feb. 4, 1995, p. A5; W. Gertz, U.S. concessions in missile pact hamper development of defenses, Wash. Times, Feb. 2, 1995, p. A8; D. Priest, GOP Urges Harder Line on Russia, Senators Want Suspension of ABM Talks, Revival of 'Star Wars', Wash. Post, Jan 25, 1995, p. A5.

18. Scylla, a nymph, became a monster and terrorized mariners in the Straits of Messina from its cave on the coast of Italy.

19. Charybdis, a whirlpool, across the strait from Scylla.

20. J. Rhineland, S. Wasserman-Goodman: "... (B)allistic missiles in the Middle East may be the greatest incentive to development of ATBMs." A. Chayes and P. Doty, eds. Defending Deterrence: Managing the ABM Treaty Regime into the 21st Century, (Wash. Pergammon-Brassey's, p.61 (1989)), hereafter Deterrence.

21. See, K. Payne, Proliferation, Deterrence, Stability and Missile Defense, "Comparative Strategy, Jan-Mar. 1994, pp. 117-129; Pamphlet, National Institute for Public Policy, Proliferation, Potential TMD Roles, Demarcation and ABM Treaty Compatibility, Sept. 1994, p. 11.

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23. See, S. Keeny, Inventing an Enemy, N. Y. Times, June 18, 1994, p. 21; K. Luongo: "(TMD) is not being driven by a serious analysis of the...threat." J. Smith, Officials Say U.S. Wants to Change ABM Treaty to Buttress Missile Defense, Wash. Post, Dec. 4, 1993, p. A22.

24. L. Aspin, Press Brief, Pentagon, May 13, 1993. Also: "... (T)he threat is here and it is upon us today." DOD News Release, (PA) No. 580-93, Dec. 7, 1993, Secretary of Defense Aspin Announces Defense Counterproliferation Initiative. The elements are; denial, arms control, diplomatic pressure, defusing (dismantlement), deterrence, offense and defense.

25. Hearing of the Senate Select Intelligence Committee, January 25, 1994, Fed. News Serv. Wash., 1994 WL 8374551.

26. CBO, note 15 p. 8.

27. Ballistic velocities generally translate into range. The table below represents the general relationship:

<u>Range</u>	<u>Altitude</u>	<u>Velocity</u>
300 km	50 km	1.4 km/s
500 km	123 km	2.2 km/s
1000 km	240 km	3.0 km/s
7000 km	1200 km	6.5 km/s
10000 km	1325 km	7.2 km/s

28. China possesses and has sold the CSS-2 with 2700 km range and reentry velocity 4.6 km/s. CBO, note 15 p. 8.

29. Hildreth, note 9 p. 12.

30. Iran, North Korea, Brazil, Israel, South Africa, and China, in addition to Nato countries and the former Soviet Union, possess, have tested or are developing TMD with velocities in excess of 3 km/s. See, H. Ewing, Ballistic Missiles: The Approaching Threat, (Centre for Defence and International Security Studies: Lancaster University, London, 1994)), p. 16-17. This velocity has been proposed as the maximum velocity against which TMD should be tested. A New Threat to the ABM Treaty: The Administration's TMD Proposal, Arms Control Today, Jan/Feb 1994, p. 13.

31. This can change rapidly. China sold the M-11 missile to Pakistan. L. Weymouth, Chinese Take-Out: Supplying Weapons to Rogue States, Wash. Post, Aug. 12, 1993, p. 27.
32. CBO, note 15 p. 8 note a.
33. Iran puts together Scud-B Missiles, Wash. Times, Dec. 5, 1994, p. 14.
34. Ibid.
35. Ed., Russia, Iran and the Bomb, N.Y. Times, Feb. 26, 1995, p.14.
36. Congress increased funding for TMD from less than \$200 million annually before the Gulf War to \$2 billion in 1994. See, CBO, note 15 p. xi. \$15 billion of the \$18 billion for missile defense during the five year defense plan is for TMD.
37. Ballistic Missile Defense Organization, 1994 Report to the Congress on Ballistic Missile Defense, July 1994, p. 2-2.
38. BMDO is working on NMD technology readiness. Upon guidance to proceed, deployment could be achieved in a reasonable time.
39. T. Postol, Lessons of the Gulf War Experience with Patriot, International Security 16:3, Wint. 1991-92 p. 119. See also, T. Postol, Whoops! Patriot Missile Sputters, San Diego Union, July 18, 1991, at B11; Defense Week, Raytheon Avenges Patriot Bashing by Downing Report, October 5, 1992 p. 18.
40. Al Hussein Scuds have @600 KM range, and 2.4 km/s reentry velocity. Postal, Lessons ibid p. 127.
41. For a description of THAAD, See, Mintz, Arms Race With an Altitude, Wash. Post, Oct. 18, 1994, p. C1.
42. Mobility is relative. It is to be moved among and between theaters of operation, but not pulled along rough combat roads.
43. In the Gronlund article the power aperture product was assumed to be 500,000 watt-m². Power aperture product is calculated by multiplying the mean emitted power of the radar by the size of the radar face. Thus calculated, 3 million watt-m² represents the maximum power aperture product allowed for non-ABM radars. Unclassified estimates of the power aperture product of the Patriot vary from 50,000 to 100,000 watt-m². See Postol, Lessons note 40 p. 124; Lin, New Weapon Technologies and the ABM Treaty, (Pergamon-Brassey's, N. Y. (1988)) p. 48.
44. Trajectory phases are boost, ascent, midcourse and terminal.

45. A single warhead may contain submunitions, which if released prior to apogee, will be difficult to counter. T. Postol, Policy Issues for Theater Missile Defenses in a Shrinking Budget, A Paper Prepared for: Reassessing Tactical and Strategic Missile Defense, U.S. House of Representatives, Oct. 29, 1991, p. 8. See Also, T. Postol, Lessons, note 39 p. 162.

46. The legal principle of rebus sic stantibus provides that changed circumstances can provide justification for escaping treaty obligations. The Treaty, Article XV, provides that parties may, upon invocation of supreme national interest and six months notice, withdraw from the Treaty.

47. See, D. Baucom, The Origins of SDI: 1944-1983, (Law. KS, Univ. Press, (1992)); G. Smith Doubletalk: The Story of Salt I, (Lanham, MD, University Press, (1985)).

48. J. Rhineland in J. N. Moore, F. Tipson and R. Turner, eds. National Security Law, (Carolina Academic Press, (1990)) p. 587. Robert McNamara told Alexsei Kosygin: "(I)f you proceed with the antiballistic missile deployment [we will] expand our offensive weapons." Kosygin responded, "...defense is moral, offense is immoral." J. Newhouse, War and Peace in the Nuclear Age, (N.Y., Alfred A. Knopf, (1989)) p. 205.

49. The Treaty is used to show treaty interpretation difficulties. J. Sweeney, C. Oliver and N. Leech, The International Legal System, (Westbury, N.Y., Foundation Press (1988)), p. 1120.

50. Preamble to the ABM Treaty, paragraph 4.

51. "What all this left unexamined was the validity of the reasoning that led to the Treaty in the first place....the extraordinary doctrine that based a nation's security on the vulnerability of its population and...missile fields. In retrospect it is less clear to me...why protection of the missile fields would not have added to strategic stability...." H. Kissinger, Years of Upheaval, (Boston: Brown & Little, (1982)) p. 1166.

52. This philosophy is embraced by missile defense opponents: If one side builds a defense, the other side will overcome it, leading to an upward offensive-defensive spiral.

53. Article I para 2 fails to define territory, region or base.

54. "I would liken MAD to two men holding revolvers...pointing their revolvers at each other's head...loaded, cocked, their fingers are on the triggers, and then to make matters worse, they're shouting insults at each other." W. Perry, remarks at National Press Club, June 5, 1995 recorded at Defense Issues, Vol. 10, Number 3, p. 1.

55. National Security note 48 p. 588.

56. "The history of warhead deployment shows a levelling off of U.S. numbers toward the end of the decade (70s) but a continuing upward trend in Soviet deployments..." World Armaments and Disarmament, The Stockholm International Peace Research Institute Yearbook 1981, 1981 p. 21.
57. See, N. K. Calvo-Goller and M. Calvo, The Salt Agreements: Content, Application, Verification (1987). Russia maintains an operational ABM system, while the U.S. deactivated its site.
58. Gerard Smith, quoted at Sweeney note 49 p. 1126. Smith was principal delegate to SALT I, and primary Treaty negotiator.
59. "Territory of its country" is undefined. Based on this the U.S. may be prohibited from defending the entire nation from its single site, depending on who is interpreting the phrase.
60. July 3, 1974 Protocol to the ABM Treaty, 27 U.S.T. 1645, T.I.A.S. No. 8276, entered into force May 24, 1976.
61. The parties retained the right to dismantle or destroy ABM systems and deploy "in the alternative area permitted by Article III of the Treaty." Thus, the U.S. may destroy its site at Grand Forks and build a new ABM system protecting Washington D.C. A decision to defend an alternative site may require re-negotiation of the Treaty. See, National Security, note 48 p. 602.
62. The smaller of these large-phased-array radars was limited to three million watt-m². ABMT, Agreed Statement B, May 26, 1972. As a general rule, radars under this threshold are not limited. ABMT, Agreed Statement F, May 26, 1972.
63. Article XII details compliance assurance: "... (E)ach Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law." Thus, intelligence assets are used to assure compliance. This does not mean in order to be legal activities have to be verifiable.
64. With one launcher at each range, the parties could legally field a defense against third world threats of one or two ICBMs.
65. See, J. Rhineland, Deterrence note 20 p. 49.
66. Smith, note 47 p. 131-32.
67. J. Rhineland, Deterrence note 20 at 53.
68. R. Garwin and T. Jarvis, Deterrence note 20 p. 84. The authors note that such a system would be vulnerable to countermeasures, and capability would vary upon the nature of the deployment, i.e., whether there was a dense or sparse employment: "The strategic situation is asymmetric, as there are no Patriots

operational in the United States and an increasing number of SA 12s are operational in the USSR."

69. T. Johnson, Ibid. at 125. In 1992 several Russian military leaders challenged Patriot to a "fly-off" and revealed that "the S-300 can simultaneously attack six targets compared to three targets for the Patriot." They claimed that the S-300 could intercept at double the range of the Patriot. Patriot Missile Challenged to Perform Against Russian System, Russian Aerospace & Technology, Apr. 20, 1992, at 1992 WL 234858.

70. T. Longstreth, J. Pike, J. Rhineland: The Impact of U.S. and Soviet Ballistic Missile Defense Programs on the ABM Treaty, (National Campaign to Save the ABM Treaty, 1985), p. 35.

71. To use a reductio ad absurdum, if a marksman with a shoulder-fired weapon knew the precise point in space where a strategic missile would be at time certain, could he theoretically destroy it? This logic can be employed for weapon systems intended and designed for TMD being "capable" against strategic ballistic missiles.

72. Aleksandr Sychev in an article entitled "Washington is Acting in An Ungentlemanly Manner by Preparing for Tests of ABM System," in Izvestiya, Jan. 18, 1995, p. 3, explained: "The start of tests on a nonstrategic ABM system in the United States is still not proof of Washington's noncompliance with the ABM Treaty, which, incidentally, in no way limits the right of participant-states to create non-strategic ABM systems." translated at FBIS SOV 95-013, Jan. 20, 1995 p. 6. And, from the same article it is apparent that the Russians view negotiations on demarcation as TMD "delimitation" talks: "Since December 1993 a standing consultative commission has been...elaborating a set of clear parameters ruling out the possibility of creating nonstrategic ABM defense systems capable...of destroying ICBMs." See also, V. Moskvina and S. Oznobischev, Russia and the United States: Is Military-Space Cooperation Practicable?, Mirovaya Ekonomika I Mezhdunarodnyye Otnosheniya, Jul. 12, 1992 p. 5, translated at JPRS-TAC-92-030, Oct. 8, 1992, p. 14: "The danger of the proliferation of ballistic missile technology in countries of the Third World...is covered by existing (the S-300 complex in the case Russia) or prospective (modifications to the Patriot air defense missile battery, (ERINT, ACES, and THAAD in the case of the U.S.) tactical abm systems, the refinement of which is not limited by the ABM Treaty in the least."

73. 1972 ABM Hearings: "Dr. Foster. SAM-D is not a mobile land-based ABM system. An example of what would make it a mobile land-based ABM system would be a program by the Army to develop a capability and then test SAM-D against strategic ballistic missiles. Senator Symington: Is there anything that prohibits the Soviets from arguing to that effect at a later date, claiming that it was? Dr. Foster: They would require evidence that the Army had conducted tests of SAM-D against strategic ballistic

missiles, or evidence that SAM-D was given capability to perform an ABM role. As long as we do not plan and conduct such tests and (emph. added) as long as we do not give SAM-D an ABM capability against strategic ballistic missiles there is no concern in that regard..." Senate Armed Services Comm., Military Implications of the Treaty on the Limitation of Anti-ballistic Missile Systems and the Interim Agreement on Limitation of Strategic Offensive Arms, 92d Cong., 2d Sess. 258.

74. A. Carnesale, Deterrence, note 20 p. 222.

75. Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on certain Measures with Respect to the Limitation of Strategic Offensive Arms, signed in Moscow May 26, 1972, 23 U.S.T. 3462, T.I.A.S. 7504.

76. The agreement did not cover nuclear warheads, strategic bombers, ship loaded missiles, short and intermediate range ballistic missiles, mobile ICBM launchers, air to surface ballistic missiles or U.S. systems based in Europe.

77. Military Implications, note 73, pp. 46,49,101, 131.

78. See, Calvo-Goller, note 57 p. 36.

79. Lin, note 43 at 16.

80. In the past the Soviet Union considered any weapon capable of reaching the territory of the other Party to be strategic. This included the U.S. weapons in Europe, but excluded Soviet missiles targeted at Europe. The U.S. considered U.S. weapons in Europe to be tactical. See, Calvo-Goller, note 57 p. 29.

81. Ibid. p. 20.

82. Regarding Patriot upgrades, Dr. Postol agreed testing against actual threats is important: "I don't understand why we didn't go to the Russians and ask them to sell us Scuds after the war," says Postol. "it's reasonable to expect to see all these ...improvements tested against...weapons they were designed for." M. Schrage Patriot Needs Real Test of Whether It can Turn in the Direction of Scud, Wash. Post, Oct. 14, 1994, Fin. p. 2.

83. Unilateral Statement B, ABMT, April 7, 1972.

84. 1978 Agreed Statement, Art. II.

85. Gronlund, note 11 p. 4.

86. Longstreth, note 70 p. 56: "... (T)he Department of Defense has...proposed...criteria for defining such a trajectory, i.e. if a target reached an altitude above 40 kilometers and a velocity greater than 2-4 kilometers per second. Although a common inter-agency position on these criteria was not reached, let alone one with the Soviets, it has been the Pentagon's position that, if a

SAM is tested against a target vehicle with such a trajectory it should be considered "tested in an ABM mode...."

87. Hildreth, note 9 p. 2 note 2.

88. As stated by Dr. Foster: "... in my view (emph. added) a flight trajectory with a maximum velocity exceeding two kilometers per second, or a maximum altitude exceeding 40 kilometers." S. Graybeal and P. McFate, Missile Debate Distorts Foster Box, Defense News, Sep. 19, 1993, Op. Ed; See also, Senate, Military Implications, note 73 at 258. Senator Symington to Dr. Foster: "That is what you think and I respect your opinion. Do you think that is what the Russians would agree to?" Dr. Foster: "I do not know sir."

89. 10 years ago the Soviets tested SA-12 against SS-12. Longstreth, note 71 at 56. SS-12 has a range of 900 km and a reentry velocity of 2.9 kilometers per second. Lin, note 43 at 13. Even though the SA-12 exceeded the "Foster Box," in a test DoD informed the Senate Armed Services Committee that: "There is nothing in its development that contravenes the ABM Treaty because that treaty deals with strategic anti-ballistic missile systems." Longstreth, note 71 at 56. Experts, including Dr. Postol, downplayed this "violation" of the Foster Box: "The SCC has never reached a common definition of what constitutes a flight trajectory with characteristics of a strategic ballistic missile...." Report, Compliance and the Future of Arms Control, Center for Int. Sec. and Arms Control, Stanford University, February 12, 1987, p. II, 30. [Hereafter Stanford.]

90. A Russian General approvingly cited the Gronlund study, but added: "The United States has been known to be using the so-called "Foster Box" principle for some time as a criterion for delimiting the testing of [missile defense] for strategic and tactical missiles." Belous understood its limited purpose. V. Belous, Theater ABM Defense. What Next?, Segodnya, 10 Feb. 1995, p. 5, translated at JPRS-TAC-95-006-L, Mar. 6, 1995 p. 38.

91. Rvs with a range of 7000 km have a reentry velocity of 6.5 km/s. 10,000 km missiles approach 7.2 km/s.

92. J. Rhineland, Deterrence, note 20 p. 56.

93. CBO, note 15 p. 49. Recently the Russians and the U.S. have apparently temporarily agreed upon the demarcation noted here, except that they have agreed to limit interceptor velocity to 3 km/s in addition to the target velocity mentioned, i.e., 5 km/s. This agreement is not final. And, such an agreement would do nothing to limit the capabilities of the hypothetical THAAD postulated by Gronlund in her attack on the administration's proposal. For details about the agreement, See, C. Giacomo, ABM Agreement with Russia is Said to Expand U.S. Anti-Missile Defenses, Wash. Post, Nov. 29, 1995, Sec. A, p. 18.

94. Report, National Defense Authorization Act for Fiscal Year 1994, P.L. 103-160, Section 232(c)(1), November 30, 1993.

95. Ibid. at Section 234(a)(7).

96. "...new weapon technologies...may erode the treaty regime unless the United States and Soviet Union explicitly take these developments into account..." Lin, note 43 at note 55.

97. National Security, note 48 p. 595.

98. Lin, note 43 pp. XIV and XV.

99. T. Longstreth, note 70 p. 68.

100. David C. Wright, Missing the Target: SDI in the 1990s, (Union of Concerned Scientists, Boston: 1992), p. 4.

101. A. Carnesale, Conference Report, Reassessing Tactical and Strategic Missile Defense, (American Academy of Arts and Sciences and System Planning Corp., 1991) p. 20.

102. Gronlund, note 11.

103. Gronlund, note 11 p. 4.

104. Ibid.

105. Ibid.

106. The assertions of the article are somewhat confusing. The THAAD-like capabilities discussed have nothing whatever with to do with the President's clarification proposal. If THAAD was never tested against targets exceeding 2 km/s what effect would that have on the Gronlund analysis?

107. This is buttressed by co-author G. Lewis' testimony before Congress: "Our analysis indicates that the required restrictions on theater defenses would have to be so stringent that they would prohibit...testing and deployment of THAAD and other similar or more capable defense systems. If so, the U.S. will...have to choose between deploying highly capable TMD systems or to continue reliance on the ABM Treaty as a means of limiting deployments of strategic defenses. The options to deploy highly capable TMD systems and to preserve the ABM Treaty appear to be incompatible with each other." Testimony before the Senate Foreign Relations Committee, May 3, 1994, WL 231095 (F.D.C.H.), USTESTIMONY Database.

108. Gronlund, note 11 p. 4.

109. "Larger detection ranges are more important to ABM capability than more capable interceptors." Lin, note 43 p. 17.

110. CBO, note 15 p. 11.

111. See, Payne, Proliferation, note 21 p. 4.
112. Gronlund, note 11 p. 7. The authors point out but do not quantify the fact that countermeasures will "complicate" the defense. An RV is a reentry vehicle, or nosecone of a missile.
113. The lack of post-boost vehicle capability is a serious omission. The uncertainty introduced by even a modest strategic post-boost vehicle could have profound implications.
114. Gronlund, note 11 p. 6.
115. Ibid.
116. Testimony of Dr. T. Postol before the HASC, April 16, 1991, 102nd Cong. 1st Sess. HASC Print No. 102-17, The Impact of the Persian Gulf War and the Decline of the Soviet Union on How the United States Does its Defense Business, p. 429.
117. Ibid. p. 436.
118. Ibid. p. 436.
119. Ibid. p. 429.
120. Accuracy degrades as the closing velocity between interceptor and target increases.
121. Wright, note 100.
122. Ibid. p. 2.
123. See note 89.
124. Stanford, note 89, p. 33.
125. Ibid p. 34.
126. Ibid p. 35. Dr. Postol on the difficulty of missile defense: "There are three basic problems that...limit the capabilities of...ballistic missile defenses....One, discriminating decoys from missiles or warheads at high altitudes in space. I know of no realistic method to do this discriminating in space. Two, discriminating decoys and missiles or warheads at lower altitudes in the atmosphere, and three, making sensor systems that cannot be degraded or destroyed by nuclear effects, electronic countermeasures or by other means...There is a fourth problem which is only relevant to SDI systems (emph added): making non-nuclear intercepts in a countermeasure environment is an unsolved problem and perhaps unsolvable...ballistic missile defenses that were contemplated prior to 1983 all depended on the use of nuclear weapons to intercept nuclear weapons. Patriot did not face any of these SDI problems. It was designed to work in the atmosphere rather than the near-vacuum of space. It did not face a threat that included

well-designed decoys. There were no electronic countermeasures for nuclear effects to disrupt its operations, and it was not attempting to intercept nuclear-armed ballistic missiles. See, T. Postol, *Testimony Before the House Armed Services Committee, Defense Policy Panel, Procurement Research Subcommittee*, SUBJECT: Patriot Missile and SDI, April 16, 1991, Dialog (R) File 660; Federal News Service. See also, Dr. Postol quoted at P. Mann, Strategic Defense Initiative Industry Studies Differ Over Coverage Provided by Accidental Launch Shield, Aviation Week & Space Technology, Apr. 4, 1988, p. 41, 42-43.

127. SS-12's apogee was 222 kilometers, and velocity 2.9 km/s.

128. Stanford, note 89 p. 30.

129. Ibid at 32.

130. Gronlund, note 11 p. 6.

131. Decibels per square meter express a ratio using base-ten logarithms. -20 DBSM is .01 square meter and -30 DBSM is .001 square meter. Less visible (to radars) targets have smaller RCS.

132. Lin note 43, pp. 77-79: "Short-range missiles (e.g. Lance) generally do not deploy an RV; instead, the entire missile penetrates. Therefore, their RCS is greatly increased over an RV associated with a longer-range ballistic missile."

133. Gronlund, note 11 p. 6.

134. To extend my example about Nolan Ryan, assume that I can only defend behind the umpire. The umpire will call the strike long before I am able, through some theoretical capability, and a long bat, to reach the ball and theoretically hit it.

135. Destructive capacity distinction between theater and strategic threats was not addressed. Radar vulnerability is intensified against strategic nuclear threats. "The stunning power of nuclear weapons should make us wary of too much theorizing about them on blackboard battlefields. And it should remind us that in matters involving nuclear weapons, humility and caution are essential." T. Postol, Ground Zero, D.C., Washington Post, April 26, 1987, p. D1.

136. Gronlund, note 11 p. 6. If Patriot had a tough time with 600 km threats, what could it hope to achieve against 10,000 km sophisticated threats? How could it protect THAAD?

137. Gronlund note 11 p. 7.

138. Ibid.

139. The authors postulate "linking" two radars of 500,000 watt-m² to obtain the desired power aperture product. Such an

effort violates only the laws of engineering, not the laws of physics, as such linking has not been accomplished, yet is theoretically possible. The difficulty is that on each radar the individual antenna elements must be positioned relative to one another in precise alignment and the radar's controlling software must have exact knowledge of the alignment in order to coherently combine the beams formed by the individual antenna elements. If two radars are to work as a single unit, their antenna faces must be aligned relative to one another at the same level of precision as the individual elements on each antenna face, and must be reproducible every time they are moved.

140. The authors make the point that even with a radar of 2 million w/m², the radar is not a violation of the Treaty. What then is the offending component? Is a cue condemned? The authors' hypothetical cue is DSP, extant at the time the Treaty was written and not forbidden by it. Is it the interceptor? The velocity of this THAAD-like interceptor is roughly equivalent to the SA-12. If the interceptor is of equal velocity to the SA-12 and the radar is not illegitimate, and the DSP cue is not illegitimate, how is THAAD a Treaty violation?

141. These kinematic flyout assessments were made at my request by Dr. John O'Sullivan.

142. See also, T. Postol, Lessons, note 39 at 124.

143. The conclusions are cited by Russians: "An analysis performed by various authors shows that antiballistic missile systems, whose development the proposed modification of the ABM Treaty is intended to permit, will not only make it possible to intercept strategic ballistic missiles but may also serve as a basis for the establishment of a system for the ABM defense of the country's territory." And, "(t)hus, the introduction of amendments to the ABM Treaty will actually make it possible to create strategic ABM defense systems under the guise of nonstrategic systems. "See, P. Podvig, Change in the ABM Treaty or Its Renunciation: Russia Must Not Agree with U.S. Amendments, translated at, FBIS, JPRS-TAC-94-014-L, Oct. 20, 1994 p. 41.

144. One day the U.S. may decide that the Treaty is an anachronism, leaving the U.S. vulnerable to undeterrable states.